



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPELLANT: Henning Henningsen)
SERIAL NO.: 09/807,394) Group Art Unit: 1722
FILED: April 12, 2001) Examiner:
FOR: RAPID PROTOTYPING) Emmanuel S. Luk
APPARATUS AND METHOD OF)
RAPID PROTOTYPING) Conf. No. 9224

AMENDED APPEAL BRIEF UNDER 37 C.F.R. §41.37

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I. THE REAL PARTY IN INTEREST

The real party in interest in this appeal is Dicon A/S. Ownership by Dicon A/S is established by an assignment document recorded for this application on April 12, 2001 at Reel 011831 and Frame 0794.

II. RELATED APPEALS AND INTERFERENCES

Neither Appellant, Appellant's legal representative, nor Assignee know of any other prior or pending appeals, interferences or judicial proceedings which may be related to,

directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Currently, claims 1-18 and 20-22 are pending and claim 19 is cancelled. All pending claims 1-18 and 20-22 are rejected under 35 U.S.C. § 103(a).

IV. STATUS OF AMENDMENTS

There have been no amendments filed subsequent to receipt of the most recent Office Action dated November 29, 2004.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A concise explanation of the subject matter defined in each of the independent claims 1, 15, and 22 involved in the appeal is provided below:

Claim 1

Independent claim 1 recites a "Rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material".

The apparatus is recited as comprising, "at least one light source for illumination of a cross section of the light-sensitive material by at least two spatial light modulators of individually controllable light modulators". A rapid prototyping apparatus, in one exemplary embodiment of Applicant's invention is shown in Figure 1. The apparatus generally includes a container 1 for holding a liquid rapid prototyping (RP) material 2, a rack 5 mounted movably thereon, a light source 6 supported by the rack 5 from which bundles of optical fibers 7 extend and connect to a plurality of individual fibers 8, i.e. light guides, which in turn connect to at least two spatial light modulators contained within an illumination device 9. Page 12, line 31 through page 13, line 25. Each of the plurality of

spatial light modulators comprises a number of individually controllable light modulators, such as, for example, micromechanical valves and/or shutters which are individually electrically controllable by connected control circuitry. *Id.*, and page 13, lines 31-32.

Claim 1 further recites, “wherein the at least one light source is optically coupled to a plurality of light guides”. As mentioned above, the exemplary embodiment of Figure 1 includes the light source 6 optically connected with bundles 7 of optical multi mode fibers. Page 13, lines 20-25. These bundles 7 spread into eight individual fibers 8. *Id.* This illustrative configuration acts as a plurality of light guides by guiding light from the light source 6 to the least two spatial light modulators contained in the illumination device 9. *Id.*

Appellant’s claim 1 further recites that the light guides are “arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section.” The exemplary embodiment of Figure 1 shows the light source 6 coupled with the bundles 7 of multi mode fiber where the bundles 7 are spread into eight individual fibers 8, i.e. light guides. Page 13, lines 20-25. Each light guide 8 illuminates a microshutter arrangement disposed in the illumination device 9. *Id.* That is, the illumination device 9 includes eight microshutter arrangements, each of which receives light originating from the light source 6 and which passes through the light guides 8. *Id.* “The entire area of light valves is illuminated by one single light guide 8 arranged in such a manner that a light beam emitted from the light guide 8 may furnish all light valves occupying an individual area with optical energy.” Page 14, lines 4-6. Via the microshutters (i.e., the spatial light modulators), the light guide 7, 8 of exemplary Figure 1 illuminate a sub-area of a cross section of the RP material 2. See, e.g., page 14, lines 8-11.

It is noted that the specification presents the apparatus of Figure 1 by way of example only in order to illustrate one embodiment of the broad concept of Appellant’s invention. With reference to Figure 1, the light guide 8 is described as multi mode fibers and the illumination device 9 is described as comprising eight microshutter arrangements. These descriptions are of course illustrative. The specification further broadly describes

the apparatus of the invention as utilizing a broad array of optic modalities and as including, generally, a spatial light modulator of individually controllable light modulators. See, e.g., page 4, lines 11-18 and page 5, lines 16-19.

Claim 15

Independent claim 15 recites a “Method of manufacturing three dimensional objects by means of a rapid prototyping apparatus”.

Claim 15 continues by reciting that, “a wholly or partially light-sensitive material is treated by at least one light source illuminating a cross section of the material by at least two modulator arrangements of individually controllable light modulators”. As discussed above concerning claim 1, Appellant’s specification describes an exemplary embodiment of the invention as comprising a rapid prototyping apparatus having a container 1 for holding a liquid rapid prototyping (RP) material 2, a rack 5 mounted movably thereon, a light source 6 supported by the rack 5 from which bundles of optical fibers 7 extend and connect to a plurality of light guides 8 which, in turn, connect to at least two spatial light modulators contained within an illumination device 9. Page 12, line 31 through page 13, line 25. Each of the plurality of spatial light modulators comprises a number of individually controllable light modulators, such as, for example, micromechanical valves and/or shutters which are individually electrically controllable by connected control circuitry. *Id.*, and page 13, lines 31-32. The RP material 2 is treated by the light source 6 which illuminates a cross section of the material 2 by way of the individually controllable light modulators of the at least two spatial light modulators of the illumination device 9.

Claim 15 additionally recites, “wherein at least one light source is optically coupled with a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section.” This limitation of claim 15 is essentially discussed above with regard to claim 1. Thus, reference is made to the above discussion.

Claim 22

Independent claim 22 recites, “Rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material”.

Claim 22 recites the apparatus as comprising, “at least one light source for illumination of a cross section of the light-sensitive material by at least one spatial light modulator of individually controllable light modulators”. As discussed above, Figure 1 of Appellant’s specification illustrates a rapid prototyping apparatus having a light source 6 disposed above a container 1 of a liquid rapid prototyping (RP) material 2. Page 12, line 31 through page 13, line 25. The light source 6 is disposed for illuminating the RP material 2 by way of at least one spatial light modulator contained within an illumination device 9. *Id.* The at least one spatial light modulator comprises a number of individually controllable light modulators, such as, for example, micromechanical valves and/or shutters which are individually electrically controllable by connected control circuitry. *Id.*, and page 13, lines 31-32.

Claim 22 further recites, “wherein the at least one light source is optically coupled to a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section”. This limitation appears in claim 1 and is discussed in detail above.

Claim 22 additionally recites, “wherein the plurality of light guides is disposed between the light source and the spatial light modulators.” As shown in Figure 1, the bundle 7 of multi mode fibers and the light guides 8 are disposed in between the light source 6 and the spatial light modulators of the illumination device 9. In this way, the light source 6 is capable of illuminating the spatial light modulators sub-areas of the RP material via the multi mode fibers 7 and light guides 8.

The above exemplary embodiments of Appellant’s specification are discussed with

respect to the aforementioned independent claims by way of example only and are not intended to in any way limit the scope of these claims. The above discussion is provided as required by 37 C.F.R. §41.37(c)(v) and not in an attempt to interpret the claims or limit the scope thereof.

VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

There are four grounds of rejection to be reviewed on appeal: (1) the rejection of claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,801,477 to Fudim (hereinafter, "Fudim") in view of U.S. Patent No. 6,051,179 to Hagenau et al. (hereinafter, "Hagenau") and further in view of U.S. Patent No. 5,790,297 to Berlin (hereinafter, "Berlin")¹; (2) the rejection of claims 3, 4, 6, 9, 13, 14, and 20 under 35 U.S.C. §103(a) as being unpatentable over Fudim in view of Hagenau and U.S. Patent No. 4,929,402 to Hull (hereinafter, "Hull")²; (3) the rejection of claims 12 and 18 under 35 U.S.C. §103(a) as being unpatentable over Fudim in view of U.S. Patent No. 5,593,531 to Penn; and (4) the rejection of claim 22 under 35 U.S.C. §103(a) as being unpatentable over Fudim in view of Hagenau and Berlin.

VII. ARGUMENT

A. REJECTION OF PENDING CLAIMS 11-18 AND 20-22, GENERALLY

In the first Office Action issued with respect to Appellant's application (see, Action dated October 07, 2002), then-pending claims 1-20 were indicated as being allowable over numerous cited references including the Fudim reference presently at issue in the outstanding Office Action. In the October 07, 2002 Action, the current examiner stated:

¹ It is noted that on page 2, item 2, of the March 09, 2005 Office Action it is stated that "Claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over by Fudim in view of Berlin (5790297)." However, the Examiner then proceeds to rely upon Fudim, Hagenau, and Berlin in rejecting these claims. Thus, herein Appellant address all three of these references with respect to the rejection of claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21.

² Here again, the Examiner initially cites Fudim and Hull but then proceeds to rely upon Fudim, Hull, and

“The prior art of record fails to teach a method of manufacturing three dimensional object by means of rapid prototyping apparatus with light sensitive material, where the light source illuminates a cross-section of the material by at least two modulator arrangements of individually controllable light modulators, the light source is optically coupled with a plurality of light guides arranged with respect to the light modular arrangement and each light guide illuminates a sub-area of the cross-section. The closest prior art, Hull and Fudim, teaches a scanning light source instead of the light guides...” Office Action of October 07, 2002, page 2.

This allowability of the claims was approved by then Supervisory Patent Examiner (SPE), Jan H. Silbaugh. However, in the subsequent Office Action dated March 14, 2003 the current examiner rejected all claims 1-20 by using Fudim as a main reference. This rejection was signed and approved by a new SPE, W.L. Walker.

It is known that a claim noted as allowable shall thereafter be rejected only after the proposed rejection has been submitted to the primary examiner for consideration of all the facts and approval of the proposed action. MPEP §706.04. It has been held that great care should be exercised in authorizing such a rejection of claims previously indicated as allowable. See *Ex parte Grier*, 1923 C.D. 27, 309 O.G. 223 (Comm’r Pat. 1923); and also *Ex parte Hay*, 1909 C.D. 18, 139 O.G. 197 (Comm’r Pat. 1909).

It is also known that full faith and credit should be given to the search and action of a previous examiner unless there is a clear error in the previous action or knowledge of other prior art. MPEP §706.04. It has been held that, in general, an examiner should not take an entirely new approach or attempt to reorient the point of view of a previous examiner, or make a new search in the mere hope of finding something. See, e.g., *Amgen, Inc. v. Hoechst Marion Roussel, Inc.*, 126 F. Supp. 2d 69, 139, 57 USPQ2d 1449, 1499-50 (D. Mass. 2001). Moreover, since it is

Hagenau in rejecting claims 3, 4, 6, 9, 13, 14, and 20. See, Office Action, page 4, item 3. Accordingly, all three references are addressed with respect to the rejection of these claims.

unusual to reject a previously allowed claim, the guidance material suggests that, when doing so, the examiner should point out in his or her office action that the rejected claim was previously allowed by using Form Paragraph 7.50:

The indicated allowability of claim [1] is withdrawn in view of the newly discovered reference(s) to [2]. Rejection(s) based on the newly cited reference(s) follow.

In the present application, the prosecuting examiner remained the same during examination but the SPE changed. Appellant respectfully submits that SPE Walker in the Office Action of March 14, 2003 did not attribute full faith and credit to the original SPE's decision of allowability of the claims as set forth in the Office Action of October 07, 2002.

The Action of March 14th rejecting the previously allowable claims did not indicate a "clear error" of the previous action nor did it declare "knowledge of other prior art" in accordance with the procedure set forth in MPEP §706.04. In fact, the above-quoted Paragraph 7.50 was not utilized whatsoever in the Office Action of March 14, 2003. Instead, the March 14th Office Action simply stated:

"The previously indicated allowability of claims 1-20 are withdrawn in view of reference(s) to Fudim. Rejections based on the cited reference(s) follow." Office Action, March 14, 2003, page 2, item 1.

As mentioned, the Office Action of October 07, 2002 already particularly considered Fudim and specifically allowed the claims over Fudim.

Accordingly, Appellant respectfully submits that SPE Walker did not attribute full faith and credit to the original SPE's indication of allowability of the claims, nor was clear error cited by SPE Walker with regard to the previous indication of allowability, nor was knowledge of new prior art cited by SPE Walker. Thus, for at least these reasons, in view of the original indication of allowability of the claims, Appellant submits that all subsequent rejections (including the presently outstanding rejections) were issued erroneously and may not stand. Accordingly, at least on these grounds reconsideration and withdrawal

of the present rejections are respectfully requested.

B. REJECTION OF CLAIMS 1, 2, 5, 7, 8, 10, 11, 15-17, and 21

Claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 are rejected under 35 U.S.C. §103(a) as being obvious over Fudim in view of Hagenau and further in view of Berlin.

This rejection is improper because (1) the prior art references do not teach or suggest all of the claim limitations; (2) there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings; and (3) there is no reasonable expectation of success. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d 1016, 1023 (Fed. Cir. 1996). These various deficiencies are now addressed in turn.

(i) The References Do Not Teach or Suggest All of the Limitations of Claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21

Independent claim 1 recites a rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material. (See claim listing below at section VIII.) The claimed apparatus is recited as comprising at least one light source for illumination of a cross section of the light-sensitive material by at least two spatial light modulators of individually controllable light modulators wherein the at least one light source is optically coupled to a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section. As will now be discussed, at least these limitations of claim 1 are not taught or suggested by the relied-upon references.

In the outstanding Office Action of March 09, 2005, the Examiner essentially asserts that Fudim discloses all of the limitations of the rejected claims except for the

recited provisions concerning ‘at least two spatial light modulators of individually controllable light modulators’. See Examiner’s comments at pages 2-3 of the March 09, 2005 Office Action. For this limitation, the Examiner points to Hagenau which allegedly discloses “a [single] spatial light modulator (11) that operates to illuminate a plurality of sub-areas (Fig. 1) from a light source (12).” *Id.* The Examiner then contends that:

The claimed invention of having several spatial light modulators that illuminate a plurality of sub-areas as compared to a single spatial light modulator that operates in the same manner, this is merely a duplication of part for multiplied effect. The use of a single spatial modulator with individual controllable modulators is able to affect an area while having multiple can affect multiple areas. However, the functions of the modulators are the same for both multiple and single. March 09, 2005 Office Action, page 3, paragraph 2.

The Examiner then proceeds to cite Berlin to illustrate that the concept of more than one light modulator located between a single light source and a display surface is known in the projective display arts. *Id.*, at paragraph 3. The Examiner concludes that it “would have been obvious to one of ordinary skill in the art to modify Fudim with the use of a spatial light modulator as taught by Hagenau and two light modulators as taught by Berlin because it allows for an increase in coverage in areas.” *Id.*, at paragraph 4.

First it is noted that neither Fudim, Hagenau, nor Berlin teach “at least two spatial light modulators of individually controllable light modulators...”, as recited in Appellant’s claim 1. Fudim discloses a single modulator disposed between a radiation source 18 and optical fibers 14. See, Figure 4 and col. 4, lines 42-48. Hagenau only discloses a single spatial light modulator 11 for projecting a pixel image 13 to optics 44 for transmission to a reservoir 17 of photoresin 16. See, Figure 1 and Col. 6, lines 8-20. Berlin discloses a display system, wholly irrelevant to rapid prototyping apparatuses, which includes a mirror based reflective display 340 consisting of a row and column array 342 of pivotal mirrors 344 disposed on a movable element 314 on a substrate 312. See, Figure 10 and col. 12, lines 9-28.

Concerning Berlin, it is noted that, a prior art reference is analogous if the reference is in the field of applicant's endeavor or, if not, the reference is reasonably pertinent to the particular problem with which the inventor was concerned. *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992). A reference is considered 'reasonably pertinent' if, even though it may be in a different field from that of the inventor's endeavor, it is one which because of the matter with which it deals logically would have commended itself to an inventor's attention in considering his problem. See, e.g., *Wang Laboratories Inc. v. Toshiba Corp.*, 993 F.2d 858, 26 USPQ2d 1767 (Fed. Cir. 1993); and *State Contracting & Eng'g Corp. v. Condotte America, Inc.*, 346 F.3d 1057, 1069, 68 USPQ2d 1481, 1490 (Fed. Cir. 2003).

Appellant's invention concerns a rapid prototyping technique and apparatus that may be used for the convenient and consistent manufacturing of large-scale prototypes while overcoming the deficiencies of known RP technologies. See, e.g., specification, page 1, line 18 through page 4, line 8. The Berlin reference concerns two dimensional display systems such as those used in portable computers, LCD multimedia projectors high definition televisions, flat panel displays, and virtual reality eyewear. Col. 1, lines 5-18. Clearly, the Berlin reference is not in Appellant's field of endeavor. Moreover, Berlin is not reasonably pertinent to the problem addressed by Appellant's invention because the subject matter of Berlin would not have logically commended itself to an inventor's attention in considering Appellant's problem to be solved. This is because, as mentioned, Appellant's invention addresses problems associated with large-scale rapid prototyping whereas Berlin concerns providing fault tolerance in tow dimensional light modulator arrays of reflective or transmissive elements used in display systems. Col. 1, lines 36-40.

Accordingly, for at least these reasons, Appellant submits that Berlin is non-analogous and may not be applied to the claimed invention; withdrawal of the Berlin reference is respectfully requested.

Returning to the substance of claim 1, a plurality of spatial light modulators of

individually controllable light modulators arranged with a plurality of light guides coupled with a light source such that each light guide illuminates a sub-area of a cross section, as claimed by Appellant, is simply not found in these relied-upon references. To reach this recitation, the Examiner states that it is “merely a duplication of part for multiplied effect” and would have been obvious in view of the teachings of Fudim, Hagenau, and Berlin.

The mere duplication of parts has been held to have no patentable significance *unless* a new and unexpected result is produced. See, e.g., *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960). As will be shown, Applicant’s claimed invention indeed provides a new and unexpected result. Thus, the relied-upon references do not teach or even suggest the invention of claim 1. Accordingly, *prima facie* obviousness is not established.

The invention of claim 1 advantageously distributes the light from a single source to a plurality of sub-areas by use of at least two spatial light modulators of individually controllable light modulators. This constitutes a vast improvement over the state of the art, represented by Fudim, which employs one light source per spatial light modulator. It is well known that the material used in rapid prototyping processes is highly light sensitive. It is also known that the illumination characteristics of the light source employed in such processes often varies significantly and unpredictably during the initial start-up and over time. Thus, prior art systems which utilize a plurality of spatial light modulators and a corresponding plurality of light sources require a high degree of monitoring and control to ensure that consistent illumination is provided by the light sources. Where one light source degenerates at a different rate than a neighboring source, hardening errors and inconsistencies may occur in the light sensitive material. For example, in one sub-area the ‘vertical’ illumination may be insufficient to provide a joining to the underlayer whereas in an adjacent sub-area a proper connection to the underlayer may be established. Additionally, where one of the plurality of prior art light sources degenerates at a different rate than the others, *all* of the light sources must be replaced in attempt to provide homogenous illumination. These deficiencies of the prior art are addressed in Appellant’s

specification at least at page 2, lines 21-30 and page 3, lines 23-30.

As mentioned, the apparatus of claim 1 comprises a light source shared by a *plurality* of spatial light modulators. This arrangement overcomes the problems of the prior art by allowing multiple sub-areas of the light sensitive material to be subjected to illumination from one light source. Thus, the illumination provided by the claimed invention is *homogenous* across a plurality of illuminated sub-areas at start-up and throughout the scanning process. The illumination may be varied or compensated as desired during use and degeneration of the light source by a simple modification of the single light source. An operator is not required to monitor and adjust multiple light sources, as in the prior art. The result is a rapid prototyping apparatus which is easy to operate and which results in consistent, predictable, and easily controllable rapid prototyping of a light sensitive material.

The use of “at least two spatial light modulators” in claim 1 does not constitute a mere duplication of a part for a multiple effect, as contended by the Examiner. To the contrary, a new and unexpected result is provided in that the problems associated with one-light-source-per-light-modulator systems (like Fudim) are substantially overcome, as discussed above. Thus, the claim limitation has “patentable significance”. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).

As conceded by the Examiner, Fudim and Hagenau fail to teach “at least two spatial light modulators” as recited in claim 1. Berlin discloses a display device, not relevant to the claimed rapid prototyping apparatus, which utilizes a plurality of mirrors to redirect light. However, Berlin does not teach a plurality of spatial light modulators of individually controllable light modulators, as recited in claim 1.

Additionally, theses relied-upon references do not *suggest* the claim limitation at issue because, as discussed above, this limitation provides a new and unexpected result not found or addressed in the references.

Accordingly, for at least these reasons, the Fudim, Hagenau, and Berlin references do not teach or suggest all of the limitations of Appellant's claim 1. Thus, claim 1 is not rendered *prima facie* obvious in view of these relied-upon references. *In re Fine*; *In Re Wilson*; *Amgen v. Chugai Pharmaceuticals Co.* (see citations above). Claims 2, 5, 7, 8, 10, 11, and 21 variously depend from non-obvious claim 1 and are thus correspondingly non-obvious.

Independent claim 15 recites a method of manufacturing three dimensional objects by means of a rapid prototyping apparatus which, similar to the apparatus of claim 1, comprises "at least one light source illuminating a cross section of the material by at least two modulator arrangements of individually controllable light modulators..." Thus, for at least the reasons expressed above concerning claim 1, the Fudim, Hagenau, and Berlin references fail to teach or suggest all of the limitations of claim 15. Accordingly, claim 15, and claims 16-17 depending therefrom, are not *prima facie* obvious with respect to the relied-upon references.

For at least the aforementioned reasons, claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 are not obvious in view of Fudim, Hagenau, and Berlin; reconsideration and withdrawal of the respective outstanding rejections is respectfully requested.

(ii) *There is No Suggestion or Motivation to Combine the Relied-Upon References in order to Form the Invention of Claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21.*

There is no suggestion or motivation, in Fudim, Hagenau, or Berlin nor in the knowledge available in the art, to modify the teaching of the references as proposed by the Examiner to form Appellant's recited invention of claim 1.

It is noted that the teaching or suggestion to make the claimed combination must be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In the Office Action, the Examiner states that one of skill in the art would have been motivated to modify Fudim as proposed to allow for an increase in coverage area based upon the disclosures of Hagenau and Berlin. However, Figure 4 of Fudim shows an embodiment of the disclosed apparatus including a radiation emitting surface 15 having a larger size, up to the full cross-sectional area of the object to be formed. Col. 4, lines 42-50. Thus, Fudim suggests increasing coverage area by increasing the size of the radiation emitting surface NOT by multiplying the number of spatial light modulators. Nowhere in the reference does Fudim discuss or allude to the use of *a plurality* of spatial light modulators, each having a plurality of individually controllable light modulators, in order to increase the area of coverage. Hagenau addresses a number of problems and deficiencies of stereolithography techniques (e.g., uneven cure profile, high maintenance, loss of repeatability and accuracy rapid prototyping machines, etc.) but does not teach or suggest the use of multiple spatial light modulators in order to increase coverage area. To the contrary, Hagenau only discloses the use of a single spatial light modulator. Berlin is directed toward image display and does not concern increasing rapid prototyping coverage area by use of multiple spatial light modulators.

Accordingly, there is no suggestion or motivation found in Fudim, Hagenau, or Berlin or elsewhere, to modify the references to form the invention of Appellant's claim 1. Moreover, Fudim, the main reference, teaches away Appellant's claim limitation concerning multiple spatial light modulators.

For at least these reasons, neither the Fudim, Hagenau, and Berlin nor the knowledge available in the art provide a suggestion or motivation to modify the reference teachings to form the limitation of Appellant's claim 1, as is suggested by the Examiner in the outstanding rejection. Thus, claim 1 is not rendered *prima facie* obvious in view of these relied-upon references. *In re Fine*; *In Re Wilson*; *Amgen v. Chugai Pharmaceuticals Co.* (see citations above). Claims 2, 5, 7, 8, 10, 11, and 21 variously depend from non-obvious claim 1 and are thus correspondingly non-obvious.

Independent claim 15 recites a method of manufacturing three dimensional objects by means of a rapid prototyping apparatus which, similar to the apparatus of claim 1, comprises “at least one light source illuminating a cross section of the material by at least two modulator arrangements of individually controllable light modulators...” Thus, for at least the reasons expressed above concerning claim 1, the Fudim, Hagenau, and Berlin and the knowledge available in the art fail to provide the require suggestion or motivation to combine and/or modify the references. Accordingly, claim 15, and claims 16-17 depending therefrom, are not *prima facie* obvious with respect to the relied-upon references.

For at least the aforementioned reasons, claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 are not obvious in view of Fudim, Hagenau, and Berlin; reconsideration and withdrawal of the respective outstanding rejections is respectfully requested.

(iii) There is No Likelihood of Success in Forming the Invention of Claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 by way of the Examiner's Proposed Modification/Combination of References.

As discussed in detail above, Fudim, Hagenau, and Berlin do not teach or even suggest all of the limitations of claim 1. Additionally, neither these references nor the knowledge available in the art provide the required suggestion or motivation to modify and/or combine Fudim, Hagenau, and Berlin as proposed by the Examiner to Form Appellant's claim 1. Thus, for at least these reasons, there is clearly no likelihood of success of forming the claimed invention through modifying of Fudim based upon Hagenau and Berlin as proposed by the Examiner. Accordingly, at least on these grounds, claim 1 is not rendered *prima facie* obvious in view of the relied-upon references. *In re Fine; In Re Wilson; Amgen v. Chugai Pharmaceuticals Co.* (see citations above). Claims 2, 5, 7, 8, 10, 11, and 21 variously depend from non-obvious claim 1 and are thus correspondingly non-obvious.

Claim 15, and claims 16-17 depending therefrom, all include the limitation at issue with respect to claim 1. Thus, for at least the reasons expressed regarding claim 1, there is no likelihood of success in forming the invention of Appellant's claims 15-17 by the

proposed combination of Fudim, Hagenau, and Berlin. Accordingly, claims 15-17 are non-obvious.

For at least the aforementioned reasons, claims 1, 2, 5, 7, 8, 10, 11, 15-17, and 21 are not obvious in view of Fudim, Hagenau, and Berlin; reconsideration and withdrawal of the respective outstanding rejections is respectfully requested.

C. THE REJECTION OF CLAIMS 3, 4, 6, 9, 13, 14, AND 20

Claims 3, 4, 6, 9, 13, 14, and 20 are rejected under 35 U.S.C. §103(a) as being obvious over Fudim in view of Hull and further in view of Hagenau. All of claims 3, 4, 6, 9, 13, 14, and 20 variously depend from independent claim 1. In the Office Action of March 09, 2005, the Examiner rejects claim 1 as being obvious with respect to Fudim, Hagenau, and Berlin. However, as discussed in the preceding subsection, this rejection is improper and must be withdrawn. Claim 1 is not further rejected or objected to in the outstanding Office Action and is thus allowable. Accordingly, claims 3, 4, 6, 9, 13, 14, and 20 which depend from claim 1 are non-obvious. Moreover, claims 3, 4, 6, 9, 13, 14, and 20 are allowable because they are not further rejected or objected. Reconsideration and withdrawal of the obviousness rejection of claims 3, 4, 6, 9, 13, 14, and 20 is respectfully requested.

D. THE REJECTION OF CLAIMS 12 and 18.

Claims 12 and 18 are rejected under 35 U.S.C. §103(a) as being obvious over Fudim in view of Penn. Both of claims 12 and 18 variously depend from independent claim 1 which as explained in the immediately preceding subsection is non-obvious and allowable. Accordingly, claims 12 and 18 which depend from claim 1 are correspondingly non-obvious. Moreover, claims 12 and 18 are allowable because they are not further rejected or objected. Reconsideration and withdrawal of the obviousness rejection of claims 12 and 18 is respectfully requested.

E. THE REJECTION OF CLAIM 22.

Independent claim 22 is also rejected under 35 U.S.C. §103(a) as being obvious in view of Fudim as combined with Hagenau and Berlin.

This rejection is improper because (1) the prior art references do not teach or suggest all of the claim limitations; (2) there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings; and (3) there is no reasonable expectation of success. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d 1016, 1023 (Fed. Cir. 1996). These various deficiencies are now addressed in turn.

(i) *The References Do Not Teach or Suggest All of the Limitations of Claim 22*

Independent claim 22 is directed to a rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material. The apparatus is recited as comprising at least one light source for illumination of a cross section of the light-sensitive material by at least one spatial light modulator of individually controllable light modulators, wherein the at least one light source is optically coupled to a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section, *wherein the plurality of light guides is disposed between the light source and the spatial light modulators*. As will now be discussed, at least this emphasized limitation is not taught or even suggested by the relied-upon references. Thus, *prima facie* obviousness is not established.

First it is noted that claim 22 recites “at least *one* spatial light modulator of individually controllable light modulators”. (Emphasis added.) This is clearly distinguished from the recitation of claims 1 and 15 concerning, “at least *two* spatial light

modulators...” (Emphasis added.) However, in the outstanding rejection of claim 22, the Examiner appears to be addressing this latter limitation concerning a plurality of spatial light modulators. See, Office Action, March 09, 2005, page 7, paragraphs 1-3. These comments are not relevant to claim 22 which recites “at least one spatial light modulator”.

Claim 22 further recites a plurality of light guides disposed between a light source and a spatial light modulator. This element of the claim is not found in the relied-upon references. The Examiner initially conceded that the recited light guides are not taught by Fudim:

“...Fudim teaches a scanning light source instead of the light guides...”
Office Action, October 07, 2002, page 3, item 5.

In the outstanding Action, the Examiner generally addresses Appellant’s “light guides” recited in claim 22,

In regards to the light guides, Fudim does teach the use of optical light guides for guiding the light from the source to the plurality of sub-areas. It is of the same function as both are used to aid in guiding the light along a path. Office Action, March 09, 2005, page 7, last paragraph.

However, in the present Action the Examiner fails to address the specifically claimed disposition of the light guides, i.e., the light guides being between the light source and the spatial light modulator. Appellant submits that this limitation is not taught or even suggested by Fudim.

Figure 4 of Fudim illustrates a container 10 for holding an uncured polymer 11, a substrate 12 disposed in the container 10, and a guide 13 located in the polymer 11 above the substrate 12. The guide 13 contains a fused bundle of optical fibers 14. The guide 13 is sealed at a lower surface by a radiation emitting surface 15 and at an upper surface by a changeable mask or aperture 20. The mask or aperture 20 includes different areas of opacities. Finally, a radiation source 18 which emits light is disposed above the mask or

aperture 20. In use, the Fudim device emits light from the radiation source 18 incident upon the mask or aperture 20 which varies the opacity thereof, thus modulating the light. Then, the modulated light radiates upon the bundle of optical fibers in the guide 13 and is delivered therethrough to the radiating surface 15 and emitted therefrom into the uncured polymer 11 of the container 10.

Thus, the light modulator of Fudim (the mask 20) is disposed between the light source (radiation source 18) and the light guides (optical fibers 14). Fudim does not teach or even suggest “light guides disposed between the light source and the spatial light modulators” as recited in claim 22.

Hagenau and Berlin disclose no light guide whatsoever analogous to the recitation of Appellant’s claim 22. Hagenau discloses a spatial light modulator 11 which projects a pixel image 13 directly to a reservoir 17 of photoresin 16. Col. 6, lines 8-19. That is, Hagenau does not teach or suggest a light guide whatsoever and further does not teach or suggest a plurality light guides disposed between a light source and a spatial light modulator, as particularly recited in claim 22. Berlin discloses a projective display system including a light source, a display surface, and a two dimensional light modulator array in an optical path between the light source and the display surface. See, Abstract. As discussed above, this reference is non-analogous and immaterial to Appellant’s claimed invention. Moreover, Berlin simply does not teach or suggest a light guide whatsoever and further does not teach or suggest a plurality light guides disposed between a light source and a spatial light modulator, as particularly recited in claim 22.

Accordingly, for at least these reasons, the Fudim, Hagenau, and Berlin references do not teach or suggest all of the limitations of Appellant’s claim 22. Thus, claim 22 is not rendered *prima facie* obvious in view of these relied-upon references. *In re Fine; In Re Wilson; Amgen v. Chugai Pharmaceuticals Co.* (see citations above).

(ii) *There is No Suggestion or Motivation to Combine the Relied-Upon References in order to Form the Invention of Claim 22.*

There is no suggestion or motivation, in Fudim, Hagenau, or Berlin nor in the knowledge available in the art, to modify the teaching of the references as proposed by the Examiner to form Appellant's recited invention of claim 22.

It is noted that the teaching or suggestion to make the claimed combination must be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

As discussed above, Fudim does not teach or suggest light guides disposed between a light source and a spatial light modulator, as recited in claim 22. To the contrary, Fudim teaches a mask 20 for modulating light emitted from a source 18 where the mask 20 is disposed between the source 18 and a guide 13 formed of bonded optical fibers 14 which transmits the modulated light to an uncured polymer 11 within a container 10. Col. 4, lines 42-64. That is, Fudim discloses a 'source-modulator-guide' arrangement while claim 22 recites a 'source-guide-modulator' arrangement. Furthermore, Fudim provides no explicit or implied teaching which would have suggested to one of skill in the art at the time of Appellant's invention to modify the disclosed arrangement of Fudim so as to dispose the guide 13 between the source 18 and the modulator 20. Fudim only discloses the modulator 20 disposed atop the guide 13 proximate to the source 18. According to Fudim, this disposition allows for easy changeability of the modulating mask 20. See, e.g., col. 4, lines 48-64. Fudim does not even hint at disposing the mask 20 or any modulator at the bottom of the guide 13 such that the guide 13 is disposed between the source 20 and the modulator 18. Figure 5 of Fudim shows an alternate embodiment having a modulating source 18 disposed at the *bottom* of the guide 13 without employing the optical fibers 14. This embodiment essentially abrogates any type of light guide and thus does not offer a suggestion or motivation to form the limitation at issue of Appellant's claim 22.

Additionally, it is further noted that a prior art reference that "teaches away" from the claimed invention is a significant factor to be considered in determining obviousness.

That is, it is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983).

As alluded to above, Fudim discloses a drive 21 for automatically changing the masks 20. Col. 4, lines 51-53. As shown in Figure 1, this automatic changeability requires disposition of the mask 20 between the source 18 and the guide 13. Accordingly, by this disclosure, Fudim teaches away from the limitation of claim 22 requiring a light guide disposed between a light source and a spatial light modulator. That is, automatically driven changeability of the mask 20 of Fudim would be substantially impaired by disposition of the mask at the bottom of the guide, within the uncured polymer 11.

For at least these reasons, Fudim provides no suggestion or motivation to combine and/or modify the teaching of Fudim to form the limitation of claim 22 concerning the disposition of the light guides.

Hagenau discloses a spatial light modulator 11 which projects a pixel image 13 directly to a reservoir 17 of photoresin 16. Col. 6, lines 8-19. That is, Hagenau does not teach or suggest a light guide whatsoever and further does not teach or suggest a plurality light guides disposed between a light source and a spatial light modulator, as particularly recited in claim 22. Thus, clearly, no suggestion or motivation is found within Hagenau which would have prompted one of skill in the art to modify Hagenau or any of the relied-upon references to form Appellant's claim 22.

Berlin discloses a projective display system including a light source, a display surface, and a two dimensional light modulator array in an optical path between the light source and the display surface. See, Abstract. As discussed above, this reference is non-analogous and immaterial to Appellant's claimed invention. Moreover, Berlin simply does not teach or suggest a light guide whatsoever and further does not teach or suggest a plurality light guides disposed between a light source and a spatial light modulator, as particularly recited in claim 22. Thus, clearly, no suggestion or motivation is found within

Berlin which would have prompted one of skill in the art to modify Berlin or any of the relied-upon references to form Appellant's claim 22.

Accordingly, for at least these reasons, neither the Fudim, Hagenau, and Berlin references nor the knowledge available in the art provide any suggestion or motivation that would have prompted one of skill in the art at the time of Applicant's invention to form the recitation of Appellant's claim 22. Thus, claim 22 is not rendered *prima facie* obvious in view of these relied-upon references. *In re Fine; In Re Wilson; Amgen v. Chugai Pharmaceuticals Co.* (see citations above).

(iii) *There is No Likelihood of Success in Forming the Invention of Claim 22 by way of the Examiner's Proposed Modification/Combination of References.*

As discussed in detail above, Fudim, Hagenau, and Berlin do not teach or even suggest all of the limitations of claim 22. Additionally, neither these references nor the knowledge available in the art provide the required suggestion or motivation to modify and/or combine Fudim, Hagenau, and Berlin as proposed by the Examiner to form Appellant's claim 22. Thus, for at least these reasons, there is clearly no likelihood of success of forming the claimed invention through modifying of Fudim based upon Hagenau and Berlin as proposed by the Examiner. Accordingly, at least on these grounds, claim 22 is not rendered *prima facie* obvious in view of the relied-upon references. *In re Fine; In Re Wilson; Amgen v. Chugai Pharmaceuticals Co.* (see citations above).

VIII. CLAIMS APPENDIX

1. Rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material, said apparatus comprising at least one light source for illumination of a cross section of the light-sensitive material by at least two spatial light modulators of individually controllable light modulators, wherein the at least one light source is optically coupled to a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section.
2. Rapid prototyping apparatus of claim 1 wherein each spatial modulator arrangement comprises transmissive light valves.
3. Rapid prototyping apparatus of claim 2 wherein said apparatus comprises a first lens arrangement, said first lens arrangement comprising at least one micro lens arranged with respect to each light valve in such a manner that that the emitted light by the light guide focuses on or in proximity of the optical axis of the individual light valves.
4. Rapid prototyping apparatus of claim 2 further comprising a second lens arrangement, said second lens arrangement comprising at least one micro lens arranged between the light valves and an illumination surface in such a manner that light transmitted through channels of the individual light valves is suitably focused on the illumination surface.
5. Rapid prototyping apparatus of claim 1 wherein optical fibers constitute the optical light guides.
6. Rapid prototyping apparatus of claim 1 wherein the at least one light source is made

of a short arc gap lamp.

7. Rapid prototyping apparatus of claim 2 wherein the individual light valves are arranged in rows in a transverse direction of a surface at a given mutual distance, said rows being mutually displaced in the transverse direction.

8. Rapid prototyping apparatus of claim 7 wherein the rows are arranged in such a manner that the projection of each individual light valve in the transverse direction on the surface results in a number of illumination points at a given mutual distance in the transverse direction.

9. Rapid prototyping apparatus of claim 1 wherein surface profiles of the spatial modulator arrangements are arranged on one or more exposure heads, said exposure heads and an illumination surface being designed to make a relative movement, said rapid prototyping apparatus being provided with a control circuitry for control of the spatial light modulator arrangements in dependency of the movement between the exposure head and the illumination surface.

10. Rapid prototype apparatus of claim 1 further comprising an exposure head comprising a bar whose relative movement over an illumination surface consists of one single progressing movement in a transverse direction of the bar.

11. Rapid prototyping apparatus of claim 1 further comprising an illumination device between the spatial light modulator arrangement and an illumination surface comprising optical means for spreading light beams emitted by the light modulator arrangement over the illumination surface.

12. Rapid prototyping apparatus according to claim 1 wherein the modulator arrangement comprises the spatial light modulators including at least one of LCD, PDLC,

PLZT, FELCD and Kerr cells.

13. Rapid prototyping apparatus of claim 1 wherein the modulator arrangement comprises reflective electromechanical light valves.
14. Rapid prototyping apparatus of claim 13 wherein the light guides are arranged with respect to the modulator arrangement in such a manner that optical energy furnished to each subset of light valves does not vary significantly once the subsets of light valves illuminate adjacent sub-areas in close proximity to each other on an illumination surface.
15. Method of manufacturing three dimensional objects by means of a rapid prototyping apparatus where a wholly or partially light-sensitive material is treated by at least one light source illuminating a cross section of the material by at least two modulator arrangements of individually controllable light modulators, wherein at least one light source is optically coupled with a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section.
16. Method of claim 15 wherein a wholly or partially light-sensitive material is placed in a layer on a plate in a container and subsequently exposed to an RP apparatus prior to creating a new layer on top of the previous layer.
17. Method of claim 15 wherein an RP apparatus is provided with a computer-aided design program wherein a 3D representation of the desired prototype is converted into files containing a cross section of the prototype and wherein the contents of the files are used to control the spatial light modulator arrangement.
18. Rapid prototyping apparatus of claim 5 wherein said optical fibers are multi mode fibers.

20. Rapid prototyping apparatus of claim 13 wherein said reflective electromechanical light valves comprise DMD.

21. Rapid prototyping apparatus of claim 1, wherein the plurality of light guides is disposed between the light source and the spatial light modulators.

22. Rapid prototyping apparatus for the manufacturing of three dimensional objects by additive treatment of cross sections comprising a wholly or partially light-sensitive material, said apparatus comprising at least one light source for illumination of a cross section of the light-sensitive material by at least one spatial light modulator of individually controllable light modulators, wherein the at least one light source is optically coupled to a plurality of light guides arranged with respect to the spatial light modulator arrangement in such a manner that each light guide illuminates a sub-area of the cross section, wherein the plurality of light guides is disposed between the light source and the spatial light modulators.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.

XI. CONCLUSION

For the reasons cited above, Appellant respectfully submits that the outstanding rejections are improper and requests reversal thereof. The Office is invited to contact Appellant's attorney at the below-listed telephone number regarding this Appeal Brief or otherwise concerning the present application for patent. Appellant hereby petitions under 37 C.F.R. §1.136 and/or §1.137 for any extension of time necessary for entry and consideration of this Appeal Brief. If there are any additional charges with respect to this Appeal Brief, or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Appellant's attorneys.

Respectfully submitted,

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Date: FEB. 13 - 2006.